

National Aeronautics and Space Administration



goddardview

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Clearing the Way for Goddard's New Building: Number 35

By Rob Gutro

NASA's Goddard Space Flight Center is about to get a new building. The site for Building 35 is currently being cleared and the land is being leveled in preparation for laying a foundation.

Building 35 will be accessible from Good Luck Road and will be the receiving point for deliveries to the Center. The shipping, receiving, and warehousing operations will be moved from Building 16W where they are currently.

The new building is being built by O'Donnell Construction Company of Washington, D.C. The contract was awarded to O'Donnell on May 18, 2010. Currently, trees are being taken down and the land is being leveled in preparation for laying a foundation.

During construction, there will be impacts to Center traffic using Soil Conservation Road and to both vehicular and pedestrian traffic near the site on Center. Upgrades for a bypass and turning lanes on Soil Conservation Road will be constructed before the new building is completed. The building is expected to be completed in the summer of 2012.

For more information about Building 35 construction, watch future issues of *Goddard View* or go to the Facilities Management Division Web site at: <http://code220>. ■



Caption: Construction equipment clear and level the site of the future Building 35.

Photo credit: NASA/Goddard/Debora McCallum

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On the cover: Maryland Senator Barbara Mikulski and NASA Administrator Charles Bolden cut the ribbon at the new Horizontal Integration Facility at NASA's Wallops Flight Facility, Wallops Island, Va. They are flanked by Dave Thompson, Chairman and CEO of Orbital Sciences Corp. (right) and William Gerstenmaier, NASA Associate Administrator for Space Operations (left).

Photo credit: NASA/Wallops

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Deadlines: News items for publication in the Goddard View must be received by noon of the 1st and 3rd Thursday of the month. You may submit contributions to the editor via e-mail at john.m.putman@nasa.gov. Ideas for new stories are welcome but will be published as space allows. All submissions are subject to editing.

NASA Ushers In New Space Exploration Era at Wallops Flight Facility

By Joshua Buck and Keith Koehler

NASA ushered in a new era of space exploration at its Wallops Flight Facility in Virginia with a ribbon cutting ceremony opening the new Horizontal Integration Facility (HIF).

The HIF will support medium-class mission capabilities. The first customer to use the facility will be Orbital Sciences Corp. of Dulles, Va., with its Taurus II launch vehicle.

"With this state-of-the-art building, NASA demonstrates its commitment to the success of the Nation's commercial launch industry," said NASA Administrator Charles Bolden, "We have already seen some fantastic progress and are looking forward to more this year. Wallops, the Mid-Atlantic Regional Spaceport, and Orbital have been working together to bring the Taurus II vehicle to the launch pad this coming fall under tough mission schedules. That effort is impressive and a model we should emulate whenever possible."



Photo credit: NASA/Wallops

Caption: Maryland Sen. Barbara Mikulski and NASA Administrator Charles Bolden cut the ribbon at the new Horizontal Integration Facility at NASA's Wallops Flight Facility, Wallops Is., Va. They are flanked by Dave Thompson, Chairman and CEO of Orbital Sciences Corp. (right) and William Gerstenmaier, NASA Associate Administrator for Space Operations (left).

Orbital will conduct missions for NASA under the Agency's Commercial Orbital Transportation Services project and Commercial Resupply Services contract. Integration of the Taurus II at the new facility will begin this month, with the first launch expected later this year.

"The Horizontal Integration Facility is a vital part of our operation at the Wallops Flight Facility," said Dave Thompson, Chairman and CEO of Orbital Sciences Corp. "The capability it provides to process two Taurus II vehicles simultaneously puts us in an excellent position to support NASA with missions to the *International Space Station*."

The facility is 250 feet long, 150 feet wide, and 60 feet high. Its bay provides dual horizontal processing with 70- and 50-ton bridge cranes. Built in approximately 16 months, the HIF has adjacent laboratory and warehouse space. Its safety features include a deluge fire suppression system and a blast-attenuating wall. ■

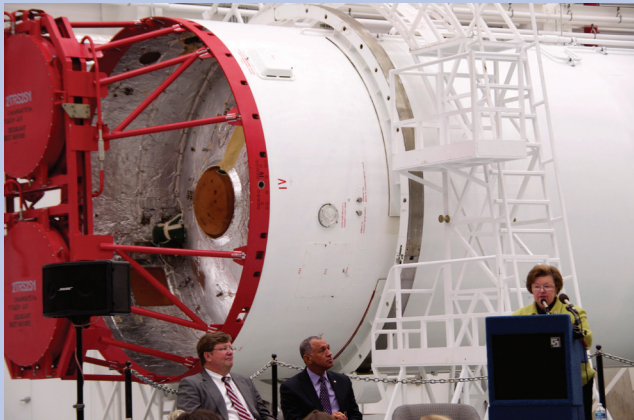


Photo credit: NASA/Wallops

Caption: U.S. Senator Barbara Mikulski addresses a standing room only crowd inside the new Horizontal Integration Facility.

"Today is about bringing jobs, jobs, and more jobs to the Lower Shore—jobs for today and jobs for tomorrow," said Sen. Barbara A. Mikulski, Chairwoman of the Subcommittee for Commerce, Justice, and Science, which funds NASA. "I'm so happy to see our Federal facilities like Wallops bringing the innovation economy to the community with this world-class international launch site that will soon launch science missions and take cargo to the *International Space Station*."

Goddard Takes over *Discover* Magazine's Top 100 Stories of 2010

By Christina Coleman

Last year, *Discover* magazine, the online and print publication for all things science and technology related, released a list of the top 100 stories of 2010. The stories ranged from groundbreaking technology to social science, and of course, new discoveries in our universe. Goddard dominated the list.

Appearing six times, Goddard stories sat among a list that included numerous international organizations, a feat in itself given the sheer amount of science organizations worldwide.

"All the scientists are loving it," said Phillip Chamberlin, a research astrophysicist for the *Solar Dynamics Observatory* (SDO) in the Solar Physics Laboratory (Code 671).

"The audience thinks these pictures and stories are great as well. The public is saying 'Hey, that's beautiful, what's that?' It's actually teaching them something and that's great. You don't have to sell the scientist on how good a mission is, the public has to love it too," Chamberlin said.

Chamberlin, who collaborated with science writer Karen Fox and Susan Hendrix, the heliophysics lead in the Goddard Office of Communications, landed at number 100 in the notable list for the story "Portrait of a Violent Star."

"It's awesome! It's not that we're just at 100 either. We also have the top 100 article cover picture, an eclipse from the Sun as seen by SDO," Chamberlin added.

As a matter of fact, the electrifying photograph taken by SDO of a fiery Sun, the white yarn-like magnetic connections and delicate violet-pink hue almost a euphemism to its true power, graced other top 2010 lists including *Universe Today*, *TIME*, BBC Science News Highlights and *National Geographic's* "The New Universe," where it came in at number four.

Another stellar story to make the list was "Mammoth Star is the Biggest One Ever Seen," a feature on a star that weighs 265 times more than our own mammoth star, the Sun. It came in at number 83.

And in a detour from stories about the universe, Liz Zubritsky and Nancy Neal-Jones came in at number 98 for their feature on "The Roving Rocks of

Racetrack Playa," an intriguing look at how hundred-pound boulders in Death Valley National Park in California seem to propel down the dry lake bed without human interaction or mechanical help. A photo gallery of the phenomenon can be viewed at: <http://www.nasa.gov/topics/earth/features/roving-rocks.html>.

"What Lies Beyond the Edge of the Universe," a feature on the "dark flow" phenomenon written by Goddard science writer Frank Reddy and *Webb Telescope* Public Affairs Officer Lynn Chandler, came in at number 76.

"This wasn't something that we ever expected to find," said Alexander Kashlinsky, a senior scientist in Code 665 who is spearheading this research. "The [research] is one of those results that require extraordinary evidence, and so far, all the evidence conforms to what we have measured," he added, speaking on the Dark Flow theory.

Dark flow is the theory that something beyond the edge of the universe is powerfully pulling on the galaxies in our universe.

"From my perspective, it validates the choices we make about the kinds of research we choose to promote. *Discover's* list covers a broad range of research conducted at institutions all over the world, so the selection of the Dark Flow story shows that the magazine's editors thought the finding was every bit as strange and fascinating as we did," said Reddy.

Out of the *Interstellar Boundary Explorer* (IBEX) mission came the number 55 story, "First Peek at the Solar System's Outer Edge," that described in detail the solar system's heliosheath.

Coming in at an astonishing number 28, "The Incredible Shrinking Moon," is a feature focused on images from the *Lunar Reconnaissance Orbiter*, with collaboration from Nancy Neal-Jones and Bill Steigerwald, that explains how new cliffy scarps along the Moon's surface indicate that it's shrinking.

For the complete list of *Discover* Magazines Top 100 Stories of 2010, please visit: <http://discovermagazine.com/columns/top-100-stories-of-2010/?searchterm=top%20100>. ■

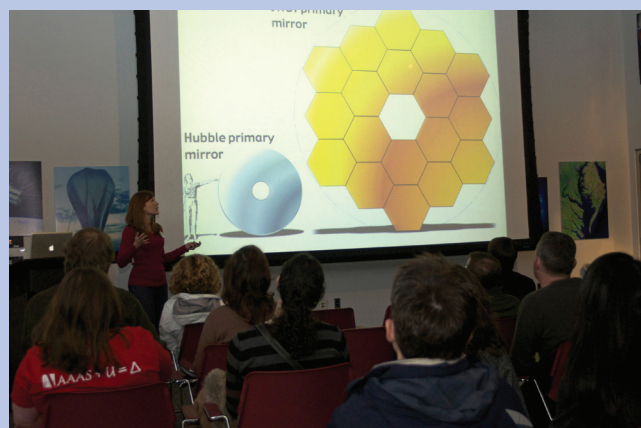
DISCOVER®

Washington D.C. Science Writers Awed by *James Webb Space Telescope* at Goddard

By Eric Villard

Members of the D.C. Science Writers Association (DCSWA) recently got an intimate look at one of the most challenging and ambitious astronomy endeavors since *Hubble Space Telescope*: the *James Webb Space Telescope* (JWST), due for launch later this decade.

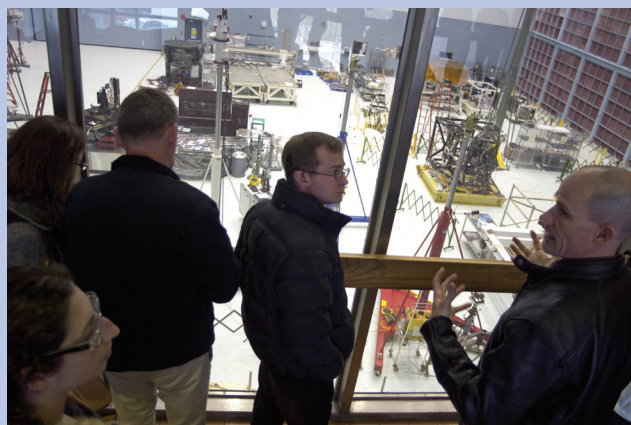
On Saturday, March 26, staff at Goddard wowed visiting DCSWA members and guests with presentations and a tour of the complex where the *Webb Telescope* is being constructed. Deputy Technical Project Manager Paul Geithner and Research Astrophysicist Amber Straughn described both the technical and scientific sides of the JWST endeavor with illustrations and arresting computer graphics simulations.



Caption: Astrophysicist Amber Straughn tells the DC Science Writers about the difference between the Hubble Space Telescope and James Webb Space Telescope mirrors.

The *Webb Telescope* is bigger than *Hubble* and promises to make even greater of discoveries about the mysteries of our universe. The telescope will allow humanity to gaze farther into the cosmos than ever before and see further back in time than was ever possible. Astronomers will use the *Webb Telescope* to see the birth of galaxies that took place 13.5 billion years ago. A little closer to home, the telescope will search for planets orbiting other stars and look for the chemistry that makes life possible.

To accomplish these lofty goals, the challenging technical hurdles of the *Webb Telescope* must be overcome and will require nothing short of perfection. To fit inside its booster rocket, the telescope will need to be folded up like a Transformer® toy. When it reaches its final destination one million miles beyond Earth, the telescope will have to unfold as gracefully as an origami crane. Technicians must polish its 18 segmented mirrors such that they deform to just the right shape when exposed to the frigid cold of space. To keep the telescope cold so that it can pick up faint radiation, a tennis court-sized sunshade must unfold flawlessly. Goddard engineers must balance the extreme heat on *Webb's* sunshield with the extreme cold on its shadowed side where the giant mirror is located. A daunting task? Not for Goddard engineers.



Caption: Deputy Technical Project Manager Paul Geithner (right) explains to a group of science writers what is being done with the Webb Telescope components in the Building 29 clean room at Goddard.

Each piece of the *Webb Telescope* is being meticulously tested at Goddard. Once the telescope is launched far beyond the Moon, there is very little that can be done to repair any faulty parts. Unlike *Hubble*, the *Webb Telescope* will not be serviceable by astronauts aboard the Space Shuttle. The successful servicing missions to *Hubble* were planned and executed by Goddard engineers.

Building on its over 50 years of experience at launching numerous Earth satellites, Goddard is putting the *Webb Telescope* through its paces. Pieces of the *Webb Telescope* are being tested with the help of a mammoth centrifuge that can duplicate the punishing forces of rocket launch. Goddard also has giant vacuum chambers that mimic the conditions of the void of space.

Today, pieces of the *Webb Telescope* manufactured in places as far as California travel the country in preparation for delivery at Goddard. Once delivered, the components enter the clean room where the *Webb Telescope* is being assembled. Standing out among the various pieces is a spare mirror segment for the telescope. The large golden shimmering object is only one of the 18 that will comprise *Webb's* vast "fly's eye" array of mirrors that will be sensitive enough to see the heat glow of a candle on the Moon.

The *Webb Telescope* is the next step in humanity's efforts to understand the universe. It is a new telescope for a new generation. Every ounce of creativity and technological know-how that Goddard scientists and engineers poured into *Hubble* is being equally poured into the *Webb Telescope*. *Hubble* gifted observers with beautiful pictures of the cosmos and encouraged curiosity about extraterrestrial happenings. The *Webb Telescope* promises to do the same on a much larger scale. ■

Goddard's Eleventh Annual Sun-Earth Day Comes with a Tweeting Twist

By Karen Fox

Every year, near the equinox, Goddard hosts – and encourages other museums and educators to host – a solar extravaganza called Sun-Earth Day. The day is part of a year-long thematic event celebrating sun science. The theme this year is Ancient Mysteries; Future Discoveries.

March 19, 2011 was the 11th Sun-Earth Day and the events at Goddard had an all-new component: it was a “Tweet-up,” a chance for active Twitter users to come together in person, experience interesting activities, and “tweet” their comments for all their followers to see. One hundred guests, chosen randomly from some 400 applicants, were invited to participate.

“Normally, when we plan a big day like this, we figure only 75 percent of the people who say they’re coming really will,” says Elaine Lewis, who runs Sun-Earth Day out of Goddard. “But this time we didn’t lose a single one.”

The day’s plan included private tours of the Smithsonian Air and Space Museum and Goddard, a live webcast from *NASA Edge*, telescope viewings of the Sun and Moon, and the chance to meet other tweeters.



Caption: Visitors get off the bus at Building 7 to start their behind-the-scenes tour of the Test and Integration Complex.

The day began bright and early with a bus ride from Goddard to the National Air and Space Museum and an IMAX movie about NASA’s *Solar Terrestrial Relations Observatory* (STEREO) mission called 3D Sun complete with 3D glasses. This was the Smithsonian’s first ever Tweet-Up, and the museum had numerous ambassadors and scholars help ferry the group around to different sites to learn about everything from early researchers of sunspots in the 1600s to Skylab’s solar research to looking through a solar telescope. All the while the tweets were flying: “Skylab was constructed using leftover parts from Apollo, including one stage of a Saturn rocket” and “Looking at solar prominences through telescopes!”

Aleya Van Doren organized the Tweet-up portion of the day. She is a member of Goddard’s Education and Public Outreach team who worked closely with NASA Headquarters for this Tweet-up. Van Doren is an active personal tweeter herself, and was pleased with how involved the social media-savvy group was. “People put photos up on Flickr within moments,” she says, “And one guest had a video camera in his hat so he could live-stream a movie for the Web.”

Before the day was long underway, the team leaders of Sun-Earth Day already knew that the group was reaching a broad audience. “By 10:00 a.m., we had 3.5 million views and an engaged audience of 788,000 people,” says Martha Wawro, another Sun-Earth Day organizer who is responsible for education and public outreach for the *Solar Dynamics Observatory* (SDO).

After the Smithsonian, the group traveled back to Goddard by bus for the chance to peek into areas of the campus that the public rarely gets to see. First up was a live webcast produced by *NASA Edge*, an offbeat NASA production team that reports on NASA science and spacecraft. The *NASA Edge* team has been involved with Sun-Earth Day since before they were even officially called “NASA Edge” and say they have a great time doing it.



Caption: A group of tweeters get to a private viewing of Goddard’s giant centrifuge used for spacecraft testing during the Sun Earth Day Tweet-Up.

NASA Edge was also doing something new this year. This was their first ever live webcast. In front of an audience, that they called the “twiterazzi,” they interviewed Goddard experts on such topics as space weather, various Heliophysics missions, and they even had a quiz for Goddard’s solar scientist Holly Gilbert in which she was asked to name all the parts of the sun. “Your job’s on the line here!” the *NASA Edge* team joked as they asked Gilbert questions. Luckily, she passed.

Goddard's Eleventh Annual Sun-Earth Day Comes with a Tweeting Twist

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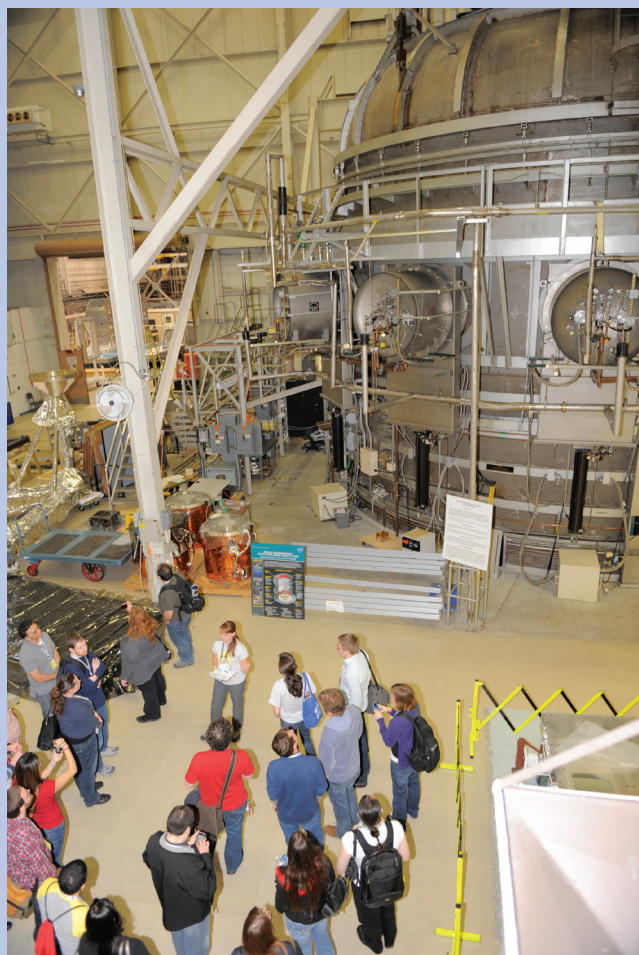


Photo credit: NASA/Goddard/Pat Izzo

Caption: Tweeterazzi get a rare look at the Thermal Vacuum Chamber.

The webcast also included pre-recorded footage from Sunspot, New Mexico, home to the National Solar Observatory and a prehistoric solar observatory site in nearby Sierra Blanca.

And then it was on to the Goddard tours. Divided into groups, the tweeters were shown the Mission Operations rooms, the visualization room filled with high resolution televisions—known as the “hyperwall”—used to present the most detailed models of climate, Earth, and Sun research, and the Integration and Testing facility where spacecraft go through a battery of pre-flight tests.

The group broke for a dinner reception provided by Honeywell (lunch earlier that day had been provided by ADNET Systems, Inc.) while door prizes were provided by the outreach teams from SDO, *Lunar Reconnaissance Orbiter* (LRO), and ThinkGeek.

The day ended with a trip to the Laser Ranging Facility to see the laser fired at the Moon, which was a favorite for many. Indeed, it was the perfect night for it, since it was the full Moon's closest approach since 1993. One tweet read: “I turn my head one way and the supermoon is rising. Turn the other way and THERE ARE LASERS IN THE SKY!”

There was another first this year, explains Wawro: an intensive evaluation of the entire Tweet-up process. All guests were given questionnaires ahead of time to judge their initial knowledge, and there will be follow-up questions to see how much was learned and how well the event went for the guests. This is all done with the intent of improving future Tweet-up events across the Agency.

But, official evaluations aside, Wawro says initial feedback was fantastic: “People were coming up to me to say things like ‘It’s been a life time’s goal to ‘feel’ NASA in person, and today I did that.’ And ‘I found my first Tweet-up experience very informative, inspiring and really, really, well, really, really fun.’ And ‘There are no words but I shall try my best to relay my experience to many back home in Uganda.’”

Yes, Uganda. There were several foreign nationals there who planned to bring their experiences home, and that, says Sun-Earth Day organizer Lewis is one thing that makes the day special for her. “I wish I could track all the things people do around the world for Sun-Earth day. We have over 200 museums that participate and people all over the world who organize events. There’s a gentleman in Iraq who gets some 3,000 people together in a city square every year to do Sun observations.”

By 10:00 p.m. EDT, the day was finally over, but that didn’t stop the tweets from rolling in, with comments on the day, calls for photo sharing, and comparisons of favorite events.

As one tweeter summed up: “Wish I could do it all over again. I miss everything we did.” ■

Goddard Interns Win First and Second Dworknik Awards for Undergraduates

By Elizabeth Zubritsky

When the Stephen E. Dworknik Awards were presented on March 7, 2011 at the Lunar and Planetary Science Conference, an intern from Goddard received the award for the best undergraduate oral presentation. A Goddard intern also won the award last year—the first time a separate award was established for undergraduates.

In March, the 2010 award was presented to Jacob Richardson, who just completed his undergraduate degree at Eastern Michigan University in Ypsilanti, Mich. The winner of the 2009 award was Paul Richardson (no relation), who finished his undergraduate degree at the University of Washington in Seattle and is now a graduate student in planetary science at the Massachusetts Institute of Technology in Cambridge, Mass.

Both interns worked with Jacob Bleacher, a geophysicist in Goddard's Planetary Geodynamics Laboratory, which is headed by Herbert Frey.

The Dworknik awards, administered through the Planetary Geology Division of the Geological Society of America, were created to encourage students to pursue planetary science. Awards of \$500 cash and a plaque are given for best oral presentation and best poster.

The undergraduate awards were separated from the awards for graduate students in 2009, but the students still have to compete with the larger pool of scientists for the opportunity to give a talk or present a poster. Bleacher sees the success of the two students as “a good demonstration that Goddard is involved in academia through ties to undergraduates and that the work the students are doing here is of high quality.”

J. Richardson says he was honored to present his work at a scientific conference and to win the award. The internship has had other benefits, too, he adds. “Every time I answered a question in my research at Goddard, I came up with three more,” he says. “I decided that’s how you know you are called to science.”

Both interns worked on a project to identify and map volcanic features in the vast plains of the Tharsis region on Mars. Bleacher is the Principal Investigator of the project, which is funded through the Mars Data Analysis Program.

P. Richardson identified and mapped different styles of lava fans—volcanic features that look like river deltas—and lava tubes in an area covering 330,000 square kilometers near the massive volcano Olympus Mons.



Photo credit: NASA/Goddard

Caption: Paul Richardson won the Dworknik award for best undergraduate presentation in 2009, the first year that a dedicated undergraduate award was given.

After determining how often lava fans and lava tubes were found near one another, he suggested a process that could explain how the fans might have formed.

He based the analysis on several sets of Mars data and learned specialized software, which he now uses routinely in his graduate studies. “Once or twice a week, [Bleacher] and I would meet and spend hours discussing different fan morphologies and the best way to identify and categorize the features,” he adds. “I consider my time at Goddard as my formal introduction into planetary science.”

J. Richardson concentrated on a section of Tharsis called Syria Planum, which is the region’s center of volcanic and tectonic activity. By looking at satellite images and elevation data, he identified 263 volcanic vents, small openings where lava erupts onto the surface. He is now using two statistics-based analyses to find out whether the vents tend to cluster together and, if they do, what that might tell him about the geology in that region.

“I’ve been able to take this part of the project and make it my own,” he says. “[Bleacher] told me, ‘This is your work, and by the time you leave, you should know more about this piece than anyone else.’ I like that.”

“I came to Goddard thinking that going into research at a university is the best career path for someone in my field,” adds J. Richardson. “But being here, with so many planetary scientists working on so many projects, really gave me a new perspective on the options that are out there.” ■

The “Opportunity Years” at the Dawn of NASA

By Daniel Pendick

Fifty years ago on March 25, Goddard's first homegrown scientific satellite roared off the pad at Cape Canaveral on a Thor-Delta rocket. Although key components came from outside the gates, *Explorer 10* was the first satellite to be designed, assembled, tested, and flown from Goddard.

James Heppner, a young space physicist (barely 30 then) and one of NASA's early employees, conceived of the mission that came to be called *Explorer 10*. Heppner functioned as a sort of one-man band—Project Manager, Project Scientist, and Principal Investigator for the magnetometer instruments on the satellite.

Before NASA was founded, Heppner worked for the Naval Research Laboratory (NRL) on the Potomac River in Washington, D.C. It was there that he developed methods to measure Earth's magnetic field. At NRL, he used sounding rockets to study charged particles and magnetic fields high in Earth's atmosphere. His earlier research in Alaska focused on the aurora and its effects on radio wave propagation, and was the basis for his California Institute of Technology Ph.D. thesis.

Heppner calls these times the “opportunity years,” a period when methods and technology for measuring magnetic fields and space plasma—the bread and butter of space physics—were being invented. He was at the right place at precisely the right time.

In late 1958, as Heppner and many of his colleagues were being “handed over” to the Nation's new aerospace agency, he had already helped create a magnetometer for the *Vanguard* program. *Vanguard*, an NRL project, was created to loft the first civilian scientific payloads into space for the International Geophysical year of 1957-58. Heppner's proton magnetometer went into space aboard *Vanguard 3* on September 18, 1959.

At the time of the transition to NASA, Heppner recalls, he conceived of a satellite to measure the magnetic field of the Moon. The mission, then called *P-14*, would accomplish its goal by extreme measures: “I originally proposed *Explorer 10* when NASA was formed,” explains Heppner, now 83. “And the intent was to try to hit the Moon and measure the Moon's magnetic field on the way in.”

The original plan was deferred. The truth is, hitting the Moon—even intentionally—was no simple trick in those days. It wasn't clear the Thor-Delta launch system would accomplish the task, and even tracking a spacecraft to the Moon was straining the technical capabilities of the time.

“With time, we realized that the odds of hitting the Moon would be extremely low, from the vehicle performance and ability to track, things like that,” Heppner explains. “I was told that with the odds of hitting the Moon being so low, it would be embarrassing to even try. So I was essentially directed by NASA Headquarters to make sure that the trajectory was such that it couldn't be interpreted as an attempt to hit the Moon.”

The new mission goal was to measure magnetism and plasma particles in space from outside of Earth's protective magnetic bubble, or magnetosphere. This had been attempted previously, but not with great success. To do it required launching *P-14/Explorer 10* into a highly elliptical orbit that would take it a great distance from Earth, dozens of times the planet's radius.

The satellite weighed approximately the same as a space physicist: 79 kilograms, or 178 pounds. “It was very light,” Heppner says. “We were trying to get distance.” An engineering model hangs in the Smithsonian if you care to look at the real thing.

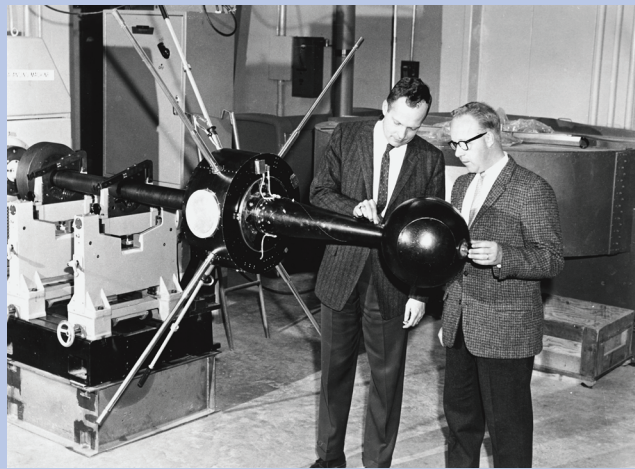


Photo credit: NASA

Caption: This photo from the early 1960s shows Goddard employees Earl Angulo (left) and Ron Browning examining an Explorer 10 model attached to a test fixture. They were responsible for the mechanical engineering and testing of the satellite.

Rubidium vapor magnetometers could measure extremely weak magnetic fields, and were a totally new technology, Heppner says. They were invented at a company called Varian Associates in Palo Alto, California. The Faraday cup plasma instrument, which measured particles streaming off the Sun's “solar wind,” came courtesy of a team of scientists at the Massachusetts Institute of Technology led by the pioneering X-ray astronomer and plasma physicist Bruno Rossi.

Finally, the big day came on March 25, 1961. The launch managers for the Thor-Delta rocket worked in “the block house” at the Cape, while Heppner and his colleagues were encamped in a machine shop, peering at oscilloscopes to assess the health of their satellite and staying in contact with the blockhouse, and the other scientists and engineers, by telephone.

Explorer 10, as was typical in those days, was powered by an expendable battery. The craft radioed back data for 52 hours as it swooped through and outside of the magnetosphere, travelling for 42.3 Earth radii—about 167,466 miles—before the battery dimmed and the craft shut down. (For comparison, consider that the average distance from Earth to the Moon is 238,857 miles.)

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OutsideGoddard: The Perfect Game

By Elizabeth M. Jarrell

Brian Campbell, an Education Specialist, just played the perfect game. Actually, according to Campbell, "I've had seven perfect games in competition. I've had lots in practice but they don't count." Campbell is a competitive league bowler. He explains that "a perfect game means that you have 12 consecutive strikes, which is when all 10 pins come down on the first roll." He bowled his first perfect game on March 20, 2000. Campbell says, "Despite my having a bunch of 300 games, I still feel nervous every time I'm about to possibly bowl a perfect game."

In bowling leagues, three consecutive games make a series. Campbell achieved his highest series in March 2010 with an 847 at Greenway Bowl in Odenton, Maryland, which broke his previous series high of 805. The beginning of April 2010, he broke the eight-year house record of an 845 series at the Brunswick Columbia Lanes in Columbia, Maryland with an 847 series. Campbell says that "Despite my breaking the eight year record, my record got broken three weeks later with an 856. My goal next season is to beat this 856."

Campbell's father was also a competitive league bowler. According to Campbell, "My dad taught me the basics of bowling how to release the ball, how to walk in on the approach, and the building blocks of how to bowl. Just the simple stuff, but obviously the most important." He has never taken any formal lessons and is largely self-taught through what he describes as "a lot of practice trying different shots and different times to release the ball and watching the pros on TV." In the end, says Campbell, "The better your competitors are, the better you are. It just forces you to bring out the best of your game."

At six feet, eight inches, Campbell's own doctor describes him as "mountainous." His daily exercise regime consists of walking about two miles a day for leg strength and lifting 70–150 pound free weights about 20 minutes a day for arm and upper body strength. Campbell offers that "I have leg pressed 1,300 pounds already, but I don't have that many weights at home." Before each game, he does about five to ten minutes of stretches, curls, and knee bends holding the bowling ball.

The only special equipment Campbell uses is his shoes and his bowling ball, but he is very particular about both items. The sliding pad on his left shoe helps him feel the wood and is part of the momentum of bowling. According to Campbell, "One of the hardest things about bowling is that if your form is off on the approach then it is almost impossible to bowl well." He has a five step approach, meaning that he takes five steps between picking up the ball until he releases the ball just before the foul line.

The approach is dependent on several variables. The floor and the lanes are usually wood but can be wood with a synthetic overlay, which is more durable and less variable. The humidity and temperature both inside and outside the bowling alley can make for a sticky or even slippery approach. Another significant variable is the oil on the lanes. A machine lays down oil



Photo credit: Jen Seay/Jennifer Seay Photography

Caption: Campbell bowling at the Maryland State Tournament.

patterns on the lane. Says Campbell, "The oil patterns range from a house shot, meaning the bowling alley's favorite type of pattern, to a sport bowling pattern, which is a little trickier, to the professional bowling shot patterns, which allow the bowler to experience the exact patterns the professionals use." "It's a crazy science. Even if you know the pattern, you still have to throw the ball right," notes Campbell.

He has a favorite company that makes his 16 pound bowling ball. He uses three balls, each with a different core material and shape and therefore different reactions on the lanes dependent on the particular oil pattern. Although he does not wear gloves, he does use bowling rosin similar to the rosin used by toe dancers or gymnasts to keep his hands dry from the sweat and also from the oil on the lane.

Competitive leagues last about 36 weeks and it costs about \$23 per week per league to play. Every league has an end of season competition or sweeper night with monetary prizes. Campbell says that basically he covers his expenses.

Campbell plays in competitive leagues three times during the week in the fall and winter leagues and twice a week in the summer leagues. Says Campbell,

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OutsideGoddard: The Perfect Game

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"I don't like bowling on weekends." These leagues range from the highly competitive men's High Roller League to the fun mixed Happy Hour League and the Atlantic City League, named because of their annual fun trip to Atlantic City. Campbell is especially proud of having won the Happy Hour League's "What the Hell Are You Doing in This League?" award. Campbell stays there because he has fun and enjoys the people. He believes that not having much down time between league seasons keeps him on his game.

The psychology of competition and resultant mindset are extremely important to Campbell. According to him, "I'd say about 70% of my game is mindset. 20% is technique. 10% is luck. Too many people don't admit to the influence of luck." For example, since the pins are set mechanically, there is always a margin of error. He explains that "if I throw the ball the exact same way, ten times in a row, I might get ten different reactions when the ball hits the pins."

For his individual mental preparation, Campbell admits that he talks to himself before each ball. Says Campbell, "I say to myself, 'Stay focused. Stay true to the game. It's just a game. Just try your best.' I try not to think too much. I know what my skills are. I don't question them. I just stay focused on what I know I can do."

He notes that "bowling is an international, competitive sport. I think it might become an Olympic sport because there is a huge following for it, especially in certain foreign countries."



Caption: Campbell at NASA's Jet Propulsion Laboratory of with the new Soil Moisture Active Passive (SMAP) Mission scale model.

At this time, Campbell does not want to turn professional. On average, a tournament costs about \$5,000 to enter and the prize is around \$50,000. According to him, "Right now bowling for me is basically competing for fun and I'm breaking even. Going professional would mean a whole new lifestyle. The serious costs involved would mean I'd have to rely on winning to break even. That would take the fun factor out of it."

"Bowling is a social outlet for me. I have lots of friends. Bowling keeps me sane," concludes Campbell. ■

The "Opportunity Years" at the Dawn of NASA

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After launch, tracking stations record data on tapes and send them to the scientists. Heppner published a number of scientific papers from the data. He headed the Goddard Magnetic Fields Group, and worked on many major missions over the succeeding years.

The next big missions for Heppner after *Explorer 10* were the Orbiting Geophysical Observatories, which grew substantially in mass and capability. He retired from the civil service in 1989, but continued to work as a contractor until 1996.

How were those days different from the later, larger, more complex place NASA has become? What was it like in the opportunity years?

"It was a very busy period in the sense that the technology was developing," Heppner explains. "The early satellites weren't very sophisticated because everything was new."

But things moved fast. Heppner summed it up best in a chapter he wrote for a 1997 book, *Discovery of the Magnetosphere*: "Opportunities for new endeavors were plentiful and the time between conception and results was unbelievably short when viewed in the light of today's space programs."

This article originally appeared in the Geeked On Goddard blog: geeked.gsfc.nasa.gov. ■

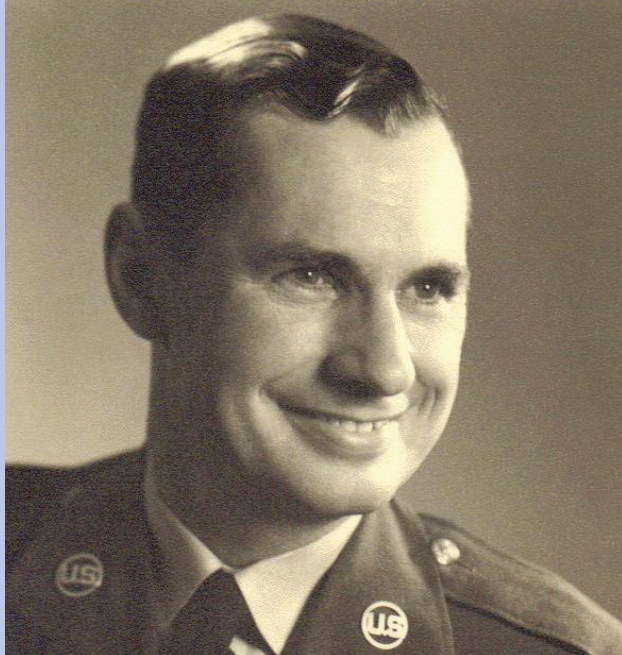
Goddard Legend Retires at 92

By April Thornton

How many colleagues do you know who retired at 92 with 70+ years at Government service? Seaton Norman, Telecommunications Manager for Code 761 retired from Goddard on September 3, 2010. He has served 30 years in the U.S. Air Force, and 40-plus years in communications at NASA. During his career at NASA, he has received the Goddard Award of Merit, the NASA Exceptional Service award, the Silver Snoopy Award, and received the NASA Space Flight Awareness Award for his many years of support for the Shuttle program.

Telecommunications Manager for Code 761, Gerald Zgonc said, "Seaton was a very well regarded and respected communications expert for GSFC Code 761 to the NASA Space Shuttle system. He was a teacher to all of us who worked with him over the 25 years that I have known him. His personality and dedication to NASA was an example for all of us to follow. No matter what your question was or what you needed to find out, he could always provide you the answer or could direct you to someone who could."

Norman was born in Mackeys, North Carolina on February 5, 1918. The family later relocated to Carson, Virginia. While most boys his age were playing with their toys, Norman was busy working on the family farm.



Caption: Seaton Norman in the U.S. Army Air Corps.

He was unsure what career path he wanted to follow after graduation. When he saw his neighbor dressed in a U.S. Navy uniform, Norman was quickly impressed. He tried to enlist in the Navy, but during that time the Navy was not allowing many people in. Norman decided to enlist in the Army Air Corps in 1935, which later became the U.S. Air Force.

Norman thought he was going to be working on airplanes, but to his surprise he was assigned to do manual labor, such as hauling coal and cutting grass for high ranking officers. A man that worked in Air Force

Communications offered to teach Norman the importance of communication, such as tuning a transmitter and knowing how to use an international code. "From that point on I did nothing but go up," said Norman.

Norman spent his last three years of military service stationed at Andrews Air Force Base just outside of Washington, D.C. He was assigned as the Superintendent of the 2045th Communications Group. He was in charge of communications in the White House and Air Force One. He retired as a Master Sergeant in November 1965. During his 30 years in the military, he was awarded a Bronze Star for his service in Korea and several Theatre of Operations awards. Norman mentioned that his experience in the military prepared him for the next career transition at Goddard.

After retiring from the Air Force, Seaton was employed by Bendix Field Engineering as a member of Goddard's Manned Spaceflight Network Support Team (NST) in 1966. This was the beginning of his association with what later became known as NASA Communication (NASCOM). In 1970, he joined NASCOM as a civil servant.

Norman was actively involved in leading the effort to provide communications services for NASA's Space Shuttle, *Apollo*, *Gemini*, *Hubble Space Telescope*, and the *International Space Station* programs. He was assigned as the NASCOM representative and was the liaison in coordinating any and all communications problems that occurred during each mission.



Caption: Norman with his wife Francis (left), daughter Diane, and son Michael.

Norman's most memorable moments at NASA were when he was selected to travel to NASA's tracking stations in both Chile and Ecuador with two astronauts, and two trips to the Moscow Control Center to discuss joint operations for the International Space Station. Norman explained the experience as overwhelming. He said that everywhere he went he was greeted and highly respected by everyone.

Norman's dedication and diligence for NASA has been exemplary. Norman mentioned he has been blessed and fortunate throughout his career. His countless awards and stories are endless, reminding him of his many accomplishments. ■